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Indian Standard

METHOD FOR DETERMINATION OF CRUSHING STRENGTH OF IRON ORE PELLETS

(First Revision)

UDC 622·341·1'188 : 539·411·43

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3 *September* 1987

AMENDMENT NO. 1 NOVEMBER 1993
TO
IS 8625 : 1986 METHOD FOR DETERMINATION OF CRUSHING STRENGTH OF IRON ORE PELLETS

(First Revision)

(*Page* 4, *clause* 3) — Add the following new clause and renumber the subsequent clauses:

'3. TERMINOLOGY

For the purpose of this standard, the following definition shall apply.

3.1 Crushing Strength

Compressing strength at which an iron ore pellet is broken completely, for which the maximum compressive load attained up to the contraction degree of 50 percent of the initial mean test piece diameter is adopted and which is expressed as the mean value of all measurements of the test sample.'

(*Page* 5, *clause* **5.3**) — Substitute the following for the existing:

'Record the maximum load where the test piece is compressed up to 50 percent. Contraction of the initial mean test piece diameter to at least one decimal place.'

(MTD 13)

Reprography Unit., BIS, New Delhi, India

Indian Standard

METHOD FOR DETERMINATION OF CRUSHING STRENGTH OF IRON ORE PELLETS

(First Revision)

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(*Continued on page* 9)

Indian Standard

METHOD FOR DETERMINATION OF CRUSHING STRENGTH OF IRON ORE PELLETS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 1 December 1986, after the draft finalized by the Ores and Raw Materials Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was earlier published in 1977. In this revision the size range of the pellets and method of testing have been modified, so as to bring it in line with international standard. Amendment No. 1 has also been incorporated in this revision.

0.3 In assessing the quality of blast furnace burden and, as such, the conditions are being laid down to ensure requisite characteristics in the quality of the raw materials. This standard is one of such standards and relates to determination of crushing strength of indurated iron ore pellets.

0.4 In the preparation of this standard assistance has been derived from the following overseas standards:

JIS-M 8718-1973 Method for measuring the crushing strength of iron ore pellets. Japanese Industrial Standards Committee.

ASTM Designation : E 382-68 T compression strength of iron ore pellets. American Society for Testing and Materials.

ISO 4700-1983 Iron ore pellets — Determination of crushing strength. International Organization for Standardization.

0.5 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

---

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the method for measuring the crushing strength of indurated iron ore pellets at ambient temperature.

1.1.1 This method is not applicable for pellets obtained after reduction.

2. SUMMARY OF METHOD

2.1 Individual iron ore pellets are placed in a compression testing machine and a load is applied at constant speed of compressive platen, until the pellet breaks which is recorded in kilograms.

3. APPARATUS

3.1 The compressive testing machine to be used is of two parts, the loading part and the indicating part, and each of the parts shall comply with the requirements given in **3.1.1** to **3.1.2.2**.

3.1.1 *The Loading Part*

3.1.1.1 The loading capacity shall be 1 000 kg or greater.

3.1.1.2 The compressive platens shall be flat and shall be installed in mutually parallel planes. They shall be made of surface hardened steel.

3.1.1.3 One of the platens (normally lower) shall move towards the other at constant speed of 15 ± 5 mm/minute over the entire test period.

3.1.2 *The Indicating Part* — The transmission of applied load to the part shall be either of load cell type or of lever type.

3.1.2.1 The indicating part of the load may be a mechanical indicator (gauge equipped with needle rider) for the lever type or may be an electrical indicator (recording chart, meter with needle rider) or the load cell type, when using a load cell, the chart recorded for response time shall be one second or less for full side deflection.

3.1.2.2 The minimum graduation shall not be less than 5 kg.

3.2 Sieves having 12·5 mm and 10 mm square mesh conforming to IS : 460-1962* shall normally be used.

4. SAMPLE

4.1 Pellet Size — The pellets to be tested shall be between 12·5 mm and 10 mm size or as agreed upon between the interested parties. The pellets shall be screened using the screens specified in **3.2** above.

---

*Specification for test sieves (*revised*).

4.1.1 *Sample Preparation* — The sample for determining the crushing strength shall be obtained at random, for example, by riffling from about 5 kg of the sample for physical testing which has been obtained in accordance with IS : 9101-1979*.

4.1.2 The sample shall be dried at 105 ± 5°C and screened to obtain the pellet size specified in **4.1**.

4.1.3 It is required to draw sixty or more number of pellets so as to fulfill the criterion given in Appendix A. Pellets selected for testing shall not contain broken or chipped pellets.

5. PROCEDURE

5.1 Place a single pellet at the centre of the lower platen of the testing machine.

5.2 Apply load at a speed of 15 mm/minute of compression platen on each pellet throughout the test period.

5.3 Record the maximum load at which the pellet undergoes complete breakage to nearest 5 kg, for each pellet.

6. EXPRESSION OF THE RESULT

6.1 The final crushing strength, expressed in kilograms, of the test sample shall be reported as the arithmetic mean value of all the readings to a whole number.

The report shall also indicate:

a) the total number of pellets tested and their individual crushing strength values,

b) size of the pellets tested,

c) the maximum and minimum strength of the pellets,

d) standard deviation of the measurements, and

e) a table of relative frequency (percent) of measurements classified at 50 kg class and graphical presentation of 'less than' frequency (percent) distribution (*see* Table 1 and Fig. 2 in Appendix B for the examples).

---

*Methods of sampling iron ore pellets.

APPENDIX A

(*Clause* 4.1.3)

SELECTION OF NUMBER OF PELLETS FOR THE TEST

A-1. The required number of pellets may be calculated from the equation (for 95 percent probability):

$$N = \frac{(2 \times E)^2}{B^2}$$

where

N = number of pellets,

E = standard deviation of strength of particular type of pellets, derived from several experiments, and

B = required precision of the mean value of measurements in kg.

It is presumed in the above calculations that the distribution of frequencies of strength values generally follow the normal curve pattern.

A-2. The relation between number of pellets and precision at different standard deviations in crushing strength is illustrated in Fig. 1.

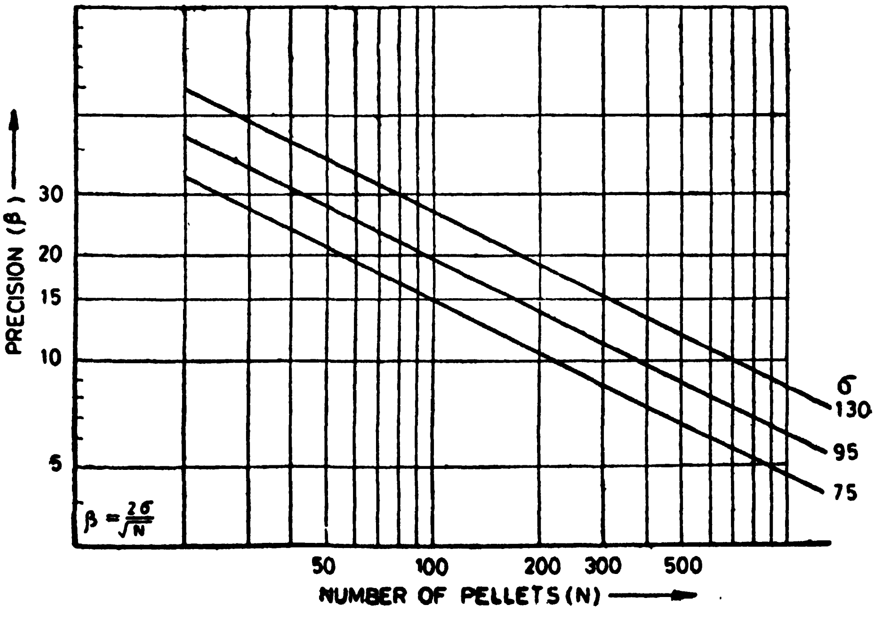

FIG. 1 RELATION BETWEEN THE NUMBER OF PELLETS AND PRECISION AT VARIOUS STANDARD DEVIATIONS

APPENDIX B

[*Clause* 6.1(e)]

AN EXAMPLE OF RELATIVE FREQUENCY OF MEASUREMENTS AND GRAPHICAL PRESENTATION

B-1. Relative frequency (percent) of measurement classified at 50 kg class is given in Table 1 and is represented graphically in Fig. 2.

TABLE 1 AN EXAMPLE OF TABLE OF FREQUENCY, RELATIVE FREQUENCY (PERCENT) AND 'LESS THAN' CUMULATIVE RELATIVE FREQUENCY (PERCENT) OF PELLETS

CRUSHING STRENGTH CLASS LIMITS (kg/p)	FREQUENCY	RELATIVE FREQUENCY PERCENT	'LESS THAN' CUMULATIVE RELATIVE FREQUENCY
101-150	4	1·6	1·6
151-200	7	2·8	4·4
201-250	20	8·0	12·4
251-300	38	15·2	27·6
301-350	50	20·0	47·6
351-400	43	17·2	64·8
401-450	31	12·4	77·2
451-500	15	6·0	83·2
501-550	23	9·2	92·4
551-600	9	3·6	96·0
601-650	6	2·4	98·4
651-700	—	—	98·4
701-750	3	1·2	99·6
751-800	1	0·4	100·0
	250	100·0	

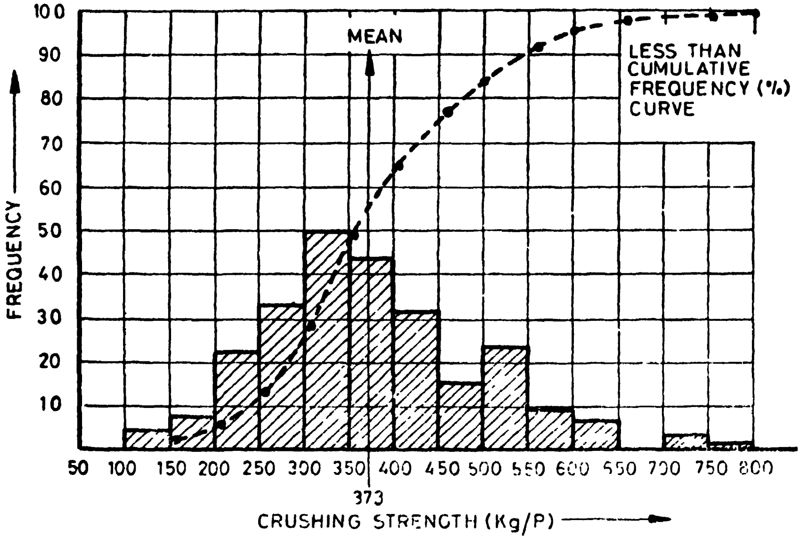

Fig. 2 Graphical Presentation of Frequency Distribution and 'Less Than' Cumulative Relative Frequency (%) of Pellets Type 'A' (N = 250; σ = 119; β = 15)

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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